Department of Health Report

Epidemiology of Bacterial Enteric Infections Under Active Surveillance in Tennessee and Georgia, 2000-2002

By Timothy F. Jones, MD; Sandra S. Chaves, MD; Timothy J. Barrett, PhD; and Matthew R. Moore MD, MPH

INTRODUCTION

Population-based active surveillance for seven common foodborne pathogens in Tennessee and Georgia demonstrates marked variation in incidence and antimicrobial resistance among pathogens, between sites, and over time. Surveillance and antimicrobial resistance data derived from well-characterized populations is critical to draw conclusions about the epidemiology of enteric diseases in this region.

BACKGROUND

It is estimated that in the United States there are roughly 0.79 episodes per person per year of acute gastrointestinal illness characterized by vomiting, diarrhea, or both. Many of these infections are caused by bacterial pathogens and may be amenable to antimicrobial treatment. However, there is substantial geographic variation in the incidence of infection with these pathogens. We analyzed data from three years of population-based active surveillance in two southeastern states to better understand the epidemiology of infections with laboratory-confirmed enteric pathogens in this region.

METHODS

The Centers for Disease Control and Prevention's Emerging Infections Program Foodborne Diseases Active Surveillance Network (FoodNet) collects data on nine enteric pathogens in nine states in the United States, including Georgia and 11 counties in Tennessee. FoodNet staff at the state level contact all clinical laboratories in the surveillance area at least monthly (94 laboratories in Georgia and 50 in Tennessee) to collect reports of all laboratory-confirmed infections with *Campylobacter*, Shiga toxin-producing *E. coli* (STEC), *Listeria monocytogenes, Salmonella, Shigella, Vibrio, Yersinia enterocolitica, Cryptosporidium parvum,* and *Cyclospora cayatensis*. We analyzed FoodNet data from the surveillance areas in Georgia and Tennessee (with a combined population of 11.0 million people in 2001) from January 2000 through December 2002. Incidence was calculated as the total annual number of cases of each bacterial pathogen under active surveillance divided by the site- and age group-specific population estimates based on the 2000 census. To account for year-to-year variation, we also calculated the mean annual incidence rates.

The National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria is a collaboration between the CDC, U.S. Food and Drug Administration's Center for Veterinary Medicine (FDA-CVM), and participating health departments. Participating health departments submitted every 10th non-Typhi *Salmonella* isolate and every 10th *Shigella* isolate to CDC for determination of susceptibility to a panel of 17 antimicrobial agents using a broth microdilution method (Sensititre, Trek Diagnostics, Westlake, Ohio). Selected laboratories (including sentinel laboratories in Georgia and Tennessee) sent the first *Campylobacter* isolate received each week to CDC for determination of susceptibility to a panel of eight antimicrobial agents using E-test (AB Biodisk, Solna, Sweden). Results of antimicrobial testing of

TABLE 1

INCIDENCE OF LABORATORY-CONFIRMED CASES OF INFECTION WITH BACTERIAL PATHOGENS UNDER SURVEILLANCE IN THE FOODBORNE DISEASES ACTIVE SURVEILLANCE NETWORK, TENNESSEE AND GEORGIA, 2000–2002

Pathogen	Annual rates per 100,000 (# cases) 2000 TN	2000 GA	2001 TN	2001 GA	2002 TN	2002 GA	Mean annual rates (per 100,000 persons)* TN	GA
Salmonella	15.0 (422)	18.0 (1474)	15.5 (438)	20.5 (1675)	19.8 (557)	22.0 (1797)	16.7	20.2
Shigella	9.3 (262)	3.9 (318)	3.5 (100)	8.7 (714)	5.1 (144)	19.5 (1598)	6.0	10.7
Campylobacter	6.4 (181)	7.2 (589)	7.6 (213)	7.5 (613)	6.4 (181)	7.8 (636)	6.8	7.5
E. coli O157	1.2 (34)	0.7 (55)	1.5 (42)	0.6 (50)	0.7 (20)	0.7 (56)	1.1	0.7
Yersinia	0.4 (11)	0.5 (45)	0.4 (10)	0.6 (50)	0.6 (17)	0.5 (43)	0.6	0.5
Listeria	0.3 (9)	0.2 (20)	0.2 (5)	0.2 (16)	0.1 (3)	0.2 (15)	0.2	0.2
Vibrio	0.0 (1)	0.1 (8)	0.1 (2)	0.3 (24)	0.2 (7)	0.3 (27)	0.1	0.2

* TN surveillance pop. = 2,818,711; GA pop. = 8,186,453

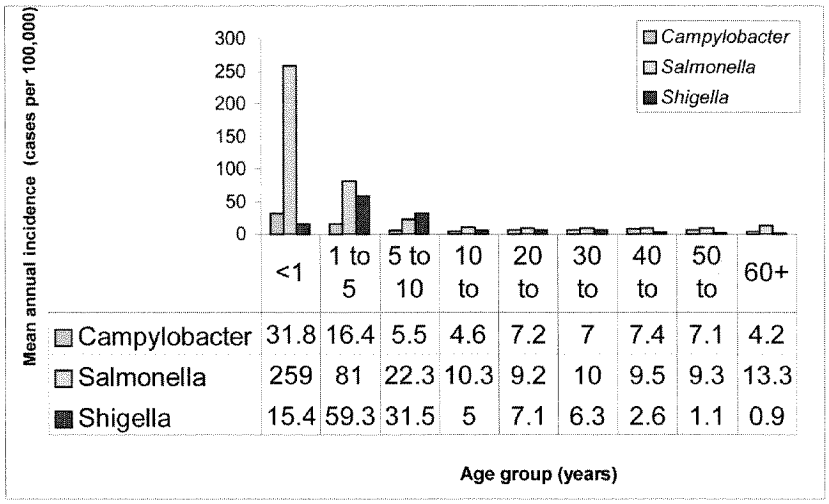

Figure 1. Mean annual incidence rates of laboratory-confirmed cases of infection with *Campylobacter*, *Salmonella* and *Shigella* by age group – Foodborne Diseases Active Surveillance Network, Tennessee and Georgia, 2000-2002.

isolates from Georgia and Tennessee in 2000 and 2001 are included in this analysis.

RESULTS

From 2000 through 2002, 12,482 cases of laboratory-confirmed infection with any of the seven bacterial pathogens under active surveillance were identified in the study area. The most commonly reported pathogen in the surveillance area was *Salmonella*, followed by *Shigella* and *Campylobacter* (Table 1). The incidence of most pathogens fluctuated over time within each site during the study period, with *Shigella* and *Campylobacter* alternating as the second-most common pathogen in different sites and years. The incidence of *Shigella* in Georgia increased five-fold from 2000 to 2002 (318 and 1,598 cases, respectively). *Shigella sonnei* accounted for the large majority of *Shigella* isolates of known serotype in both Georgia (90%) and Tennessee (93%). Similarly, rates of *Salmonella* varied by as much as 28% from year to year within sites.

Salmonella and *Campylobacter* disproportionately affected infants and young children, while the highest rates of Shigella were noted in preschool and school-aged children (Figure 1). *Yersinia* was the third most common pathogen among infants in both sites (23 cases per 100,000 in both sites combined). We observed less variation in the incidence of infections with *Salmonella*, *Campylobacter*, and *Shigella* among people more than 10 years of age.

During the study period, 531 non-Typhi *Salmonella* isolates, 108 *Shigella* isolates, and 162 *Campylobacter* isolates were available for antimicrobial resistance testing. Among all 531 non-Typhi *Salmonella* isolates, 75 (14.1%) were resistant to ampicillin, 7 (1.3%) were resistant to trimethoprim-sulfamethoxazole, and only 1 isolate was resistant to ciprofloxacin. Of 117 *Salmonella* Typhimurium isolates, 51 (44%) were resistant to ampicillin. Among *Shigella* isolates, resistance to ampicillin was identified in 94% of specimens from Georgia and 78% from Tennessee; resistance to trimethoprim-sulfamethoxazole was detected in 24% and 47% of isolates, respectively. Among *Campylobacter* isolates, 24 (23%) from Georgia were resistant to ciprofloxacin, as were 7 (12%) from Tennessee.

DISCUSSION

From 2000 through 2002, *Salmonella* was the most common cause of laboratory-confirmed bacterial gastroenteritis in the surveillance areas of Tennessee and Georgia, consistent with findings from other FoodNet states and from the United States overall. Incidence rates of all common enteric pathogens vary by site and over time. While public health reporting of communicable diseases is imperfect, the data obtained from population-based, active surveillance represent the best available estimates of the incidence of laboratory-confirmed infections in the surveillance areas.

Rates of infection with *Shigella* varied dramatically in these sites, as it has in other states during widespread community outbreaks. In Georgia, for example, the incidence of shigellosis increases and decreases in cycles lasting about seven years. Substantial increases in shigellosis began in Georgia in 1987, 1994, and are observed again in 2001. Cases there are evenly distributed among black and white populations, and predominantly occur among preschool and school-aged children and their caretakers and family members (Georgia Department of Human Resources, unpublished data). The incidence of infection with *Shigella* in Tennessee also follows a dramatic cyclical pattern, with a rate in 1998 over seven times greater than that reported in 2001 (Tennessee Department of Health, unpublished data).

Because infections caused by *Vibrio*, *Yersinia*, and *Listeria* are relatively uncommon, the incidence of those infections are influenced substantially by even small outbreaks. The incidence of *Yersinia* in Tennessee in 2002, for example, was greater than 50% above baseline because of a single outbreak among black infants attributed to exposure to chitterlings.

The rates of drug-resistance among isolates of *Salmonella*, *Shigella*, and *Campylobacter* in these sites were similar to those in other recent comprehensive studies. Increasing rates of resistance to commonly used antimicrobial agents is an alarming

trend with important implications for clinicians. Recent national recommendations regarding drug therapy for selected cases of bacterial gastroenteritis have taken these trends into consideration.

The proportions of *Shigella sonnei* isolates resistant to trimethoprim-sulfamethoxazole in Georgia (21%) and Tennessee (45%) in this study differed substantially from the findings of a study in a small area of South Carolina (0%). There are at least three possible explanations for these differences. First, these findings may reflect true differences in the prevalence of antimicrobial resistance among *Shigella sonnei* isolates. Such differences highlight the importance of having reliable local data on antimicrobial susceptibility for clinical decision-making. Second, these differences may indicate differences in the underlying population from which the cases were ascertained (e.g., age distribution or the frequency of antimicrobial use in the population). Finally, local outbreaks of shigellosis, by definition, lead to dissemination of a single clone of the organism that in turn would influence heavily the prevalence of antimicrobial resistance. These latter two reasons highlight the importance of population-based active surveillance because it improves the ability to characterize trends among well-defined populations.

Care must be taken to avoid generalizing conclusions about the prevalence of pathogens based on incidence in a limited area or period. As observed here and in other studies the incidence of infection with enteric pathogens can vary dramatically among geographic sites, among age and racial groups, and over time. Similarly, marked variability in antimicrobial susceptibility rates is observed among pathogens and between sites, even in large population-based surveillance systems. Therefore, current local data should be used to guide clinical decision-making for individual patients and data derived from large, well-defined populations are necessary to determine the extent to which local data can be generalized. ■

From the Tennessee Department of Health, Nashville (Dr. Jones), the Georgia Department of Human Resources, Division of Public Health, Atlanta (Dr. Chaves), and the Centers for Disease Control and Prevention, Atlanta Drs. Barrett and Moore). Dr. Jones is the Tennessee Deputy State Epidemiologist.